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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING AND GRINDING - 1983

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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING 1983

by

D.C. LUMB

ABSTRACT

This report is a comprehensive bibliography of the latest machinery, techniques and crushing-grinding circuits for the year 1983.

Keywords: Crushing, Grinding, Crushing Mill, Grinding Mill, Grinding Circuit, Process Control, Automation.

RÉPERTOIRE BIBLIOGRAPHIQUE DES TECHNIQUES DE CONCASSAGE ET DE BROYAGE UTILIÉS EN 1983 - TRAVAIL RÉALISÉ PAR CANMET

PAR

D.C. LUMB

RÉSUMÉ

Ce rapport constitue une bibliographie exhaustive de la machinerie, des techniques et circuits de concassage et de broyage les plus récents utilisés en 1983.

Mots clé: Concassage, broyage, appareils de broyage, broyeurs, circuits de broyage, contrôle des opérations, automation.

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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING 1983

INTRODUCTION

This report presents bibliographical information on the subject of crushing and grinding. Articles were categorized and numbered sequentially according to the yearly quarter in which they were cited. Although some ambiguity may exist in the article allocations, the categories were chosen to facilitate specific subject searches while retaining the convenience of a general breakdown.

REFERENCING SYSTEM

The references in this report were obtained through the CAN/SDI system covering the 1983 issues of the following data bases:

CHEMICAL ABSTRACTS
COMTENDEX
METADEX (Metals Abstracts)
NTIS (National Technical Information Service of the U.S. Dept. of Commerce)
SCIENCE CITATION INDEX

The references were numbered according to the months in which the data bases cited the reference. A photocopy of each article was made and may be found filed according to its reference number at the CANMET Mineral Ore Dressing Laboratories, 552 Booth St. Also at the same location is an author-index listing various authors and their articles for which photocopies have been made.

The references appearing in this report were numbered in the following method:

January, February, March 1983	2000 - 2061
April, May, June, July 1983	2070.00 - 2070.51
August, September, October 1983	2100 - 2152
November, December 1983, January 1984	2160.00 - 2160.44

ACKNOWLEDGEMENT

I would like to the thank the support and cooperation of W.H. Cameron, J. MacCauley, Canada Centre for Mineral and Energy Technology, and Energy, Mines and Resources Canada.

1983 (A) REVIEW AND GENERAL ARTICLES

2025 Eicke, G., Schwendig, G. "Construction and Safety of Central Grinding Plants for Coal/Ausfuehrung und Sichereit von Kohle-zentralmahlanlagen"; Zement Kalk Gips, Ed.B, Vol. 35, No. 5, May 1982, pp. 239-245; 12 Refs.; ZKG8D

1 - Grinding Mills; Coal Preparation; Coal Pulverizers A533; A802; A524

The central coal grinding plant operated with inert gas (whether or not supplied from an outside source) or with air is examined, and the mechanical equipment and operational safety of the plant are discussed. In German with English abstract.

2026 Anon. "From Raw Mill Grinding to Finish Cement"; Pit Quarry, Vol. 75 No. 2, Aug 1982, pp. 40-45; ISSN-0032-0293; PIQUA

1 - Cement Plants - Computer Aided Manufacturing; Computers, Digital A412; A723

This new cement plant with annual capacity of 1.5 million tons is controlled by an advanced process control instrumentation that helps assure quality and continuity of production. The system, a field proven direct digital process control (LN 5400) computer, is centrally located and manages all major processing operations from raw mill blending to finish grinding. The article shows layout and graphic outputs controlling different production stages from a central command.

2030 Ramsey, T.L. (Pincock, Allen & Hold Inc. ucson, Ariz. USA), "Reducing Grinding Costs: The Potential is Great"; World Min., Vol. 35, No. 10, Oct 1982, pp. 78-81; ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533; A911

The article discusses autogenous and semiautogenous grinding, circuit design, rod mills, ball mills, the angular spiral lining system and tower mills.

2039 Roller, P.W. (Cent. Res. Lab. UK (GB)), "Granulation of Iron Ores"; BHP Tech. Bull., Vol. 26, No. 1, 1982, pp. 44-5; ISSN 0005-3074 BHPBA

CA154002; Iron Ore Granulation

Granulation, Iron Ores

2056 O'Murchu, D. (Tara Mines Ltd., Navan, Irel), "Tara Mines Story: Ore Processing at Tara"; Trans. Inst. Min. Metall., Sect. A, Vol. 94, Jan. 1985, pp. 21-28; Refs.; ISSN 0371-7844; TIMNA

A531; A533; A504; A802; 1 - Ore Treatment; Lead Zinc Deposits - Ireland; Flotation; Crushing and Grinding; Chemical Operations - Leaching; Slurries; Dewatering

Treat: A (Applications); M (Management Aspects)

Run of mine-ore from Tara Mines in Ireland undergoes primary crushing underground and is hoisted to a coarse-ore storage bin on surface, from which it is fed to the secondary and tertiary crushers within the mill building to produce fine ore. This, in turn, is stored in bins. The two-stage wet grinding circuit is fed from the ore bins, and the slurried product from the grinding mills passes directly to the flotation circuits. A lead concentrate is extracted first, followed by a zinc concentrate. Zinc concentrates are leached with sulphuric acid to remove dolomite, so bringing the product within smelter specifications. Each of the concentrates is then dewatered by thickening and subsequent vacuum filtration. The filter cakes are dried in oil-fired rotary drum dryers to reduce moisture contents to levels suitable for shipment.

2057 Grujic, Milorad; Dcepek, Drago; Salatic, Dusko; Mitic, M. (Majdanpek, Yugoslavia (YU)), "Current Developments in Comminution for Copper Flotation at Majdpanek"; Rud.-Metal. SB., Vol. 29, No. 2-3, 1982, pp. 155-65; ISSN 0035-9645 RMZBA

CA154001; Copper Ore Flotation Grinding

Ore Treatment, Copper Ores

2058 Chamberlain, C. (Newmont Holdings Pty. Ltd., Herberton, Australia (AU)), "Telfer - Australia's Newest Gold Mill"; Min. Eng. (Littleton, Colo.) Vol. 34, No. 3, 1982, pp. 281-4; ISSN 0026-5187; MIENA

CA154002; Gold Recovery Gravity Cyanidation

7440-57-5

2070.40 Sakata, T.; Matsumoto, K.; Hayashi, N.; Watanabe, T.; Yamaguchi, H.; Koga, T., Brundiek, H., "One-Kiln-One-

Mill System at Osaka Cement"; Zement Kalk Gips. Vol. 36, No. 2, 1983, pp. 75-80; Ref: 000

2070.47 Kollberg, G., (Sala Mach Works Ltd. Mississauga, Ont. Can.), "Sala Caravan Mill - Synopsis: A Technical and Economical Presentation"; CIM. Bull Vol. 75, No. 847, Nov., 1982, pp. 95-7; ISSN 0317-0926; CIBUB

1 - Ore Treatment - Equipment A 533

The Sala Caravan Mill system represents a proven concept for the design and operation of mobile and semi-mobile ore dressing plants. The first installation was put into operation in 1970 and a number of plants have been delivered world-wide since then. The system has flexibility in both a capacity, ranging from 50 to 1000 tons per day, and in process combinations.

2104 Melis, Lawrence, A.; Fraser, Kevin, S.; Lakshmanan, V.I, "Midwest Uranium Project - Development of the Milling Process"; CIM. Bull., Vol. 76, No. 852, Apr. 1983, pp. 113-123; 17 Refs. ISSN 0317-0926; CIBUB

1 - Uranium Ore Treatment - Saskatchewan A533

This paper describes the development of a milling circuit for a high-arsenic uranium ore typical of that found in northern Saskatchewan. Also described are waste circuits which have been established to produce effluents of acceptable quality and pilot-plant testing of sub-aerial tailings deposition.

2112 Salotti, C.A.; Datta, R.S., "Size Reduction of Green River Shale"; In: Gary JH, Sixteenth Oil Shale Symposium Proceedings, 1983, pp. 394-412; Ref. 000 Pub: Colorado School Mines Press; Golden; CO80401;

16th Oil Shale Symp. Held: Golden; Co; 83/4/13-15

ISBN: 0-918062-56-X

2116 Astier, J. "The Growing Importance of Direct Reduction in the Iron Ore Business"; 2nd International Iron Ore Symposium, Frankfurt, West Germany, 23-24 March, 1981, Metal Bulletin, Park House, Park Terrace, Worcester Park, Surrey KT4-7HY (1981) D.1-D.15

42, Iron Ores, Reduction (Chemical), Direct Redution, Economics, Forecasting

See Met. A., 8303-72-0173. Traditional iron and steelmaking routes are compared with direct reduction in terms of quality and quantity of product, types of energy used, investment costs, manpower requirement and environmental effects. Direct reduction (DR) is assessed on the basis of existing processes, new processes, and utilization of the product. Existing DR is very suitable for countries with large natural gas resources, whereas new DR processes may use coal or combinations of gas, oil and coal; they may also use cheaper fines or concentrates instead of lump ore and pellets. The advantages of integrating DR with electric arc steelmaking in one plant are discussed. The iron ore market will be affected by DR feed requirements, the quantities needed, and the locations of DR plants around the world. It seems likely that DR will use more high grade natural ores or concentrates. Therefore, in some countries, iron ore exports will decrease as more is used in their own local DR plants. By 1990, it is forecast that around 40M tonnes of high grade ores or pellets will be needed for DR plants located in areas where no local supplies exist.

2128 Polgaire, J.L.; Predali, J.J. (Brgm. Fr. (FR)), "Recent Progress in the Physical Treatment of Fine Complex Sulfide Ores"; Ind. Miner., (Ser.) Tech., No. 3, 1983, pp. 84-90; ISSN-0240-9542; INMTD

CA165000; Review Sulfide Ore Flotation

Ore Treatment, Zinc Ores, Lead Ores, Copper Ores

2135 Giencke, Donald P. (Allis-Chalmers Corp. Solids Process Equipment Div. USA), "Planing Your Grinding Mill Installation"; Pit Quarry, Vol. 75, No. 9, Mar. 1983, pp. 54-57; ISSN-0032-0293; PIQUA

1 - Grinding Mills - Design A533

This article reviews design considerations in order to reduce maintenance.

2149 Denoes, A.; Predali, J.J.; Ranchin, G. (Soci/t/ Metallurgique Nickel), "Process of Upgrading Nickeliferous Oxide Ores of Lateritic Origin"; Off. Gaz., 7 Dec. 1982. Pat: US4362558 (USA) 14 Aug., 1975, Pub: IBSN: IBSN: ISSN: 0360-5132

41, Nickel Ores, Beneficiation, Grinding (Comminution), Screening (Sizing)

A process for upgrading garnieritic ores to obtain an upgraded ore of higher Ni content comprises: subjecting a carnieritic ore in which approx. 80% of the ore particles have a size between approx. 5000-100 MU M to a controlled attrition to produce fine particles whereby a ration D Sub 90/D Sub 10 measured after the controlled attrition is larger by a factor of at least 2.0 than a ration of D Sub 90#D Sub 10 measured before the controlled attrition and whereby D Sub 90 measured after the controlled attrition is not > 75% < D Sub 90 measured before the controlled attrition; and classifying the ore particles resulting from the attrition according to their size into at least two fractions and recovering the ore particles of a size < 50 μm as the upgraded ore of higher Ni content.

2151 Smith, Robert L. JR. (GE), "Use Specified Enclosures, Insulate Stators Correctly, Align Mill and Motor Shafts"; Pit Quarry, Vol. 76, No. 1, July 1983, pp. 62-65; ISSN 0032-0293; PIQUA

1 - Grinding Mills - Ball Milling; Cement Plants - Equipment A 802; A412

The article discusses two aspects of successful ball mill motor installations: (1) motor enclosures and winding treatment designed for cement plant environments; (2) installation alignment techniques for ball mill motors to assure minimum OPE rational difficulties.

2160.04 Mebdery, J.L.; Nielsson, F.T. (Int Minterals & Chem Corp Atlanta GA 30346), "Fundamentals of Granulation"; Industrial & Engineering Chemistry Product Research and Development, Vol. 22, No. 2, 1983, pp. 291-296; Ref. 003

2160.15 Rieger, K.; Clement, M.; Uetz, H., "Fineness, Linear Wear and Energy Consumption in Grinding Circuits of Rocks and Ores. Investigations in a Laboratory Mill". (Translation: Mintek-TR-1154); Erzmettal, no. 2, 1982, pp. PP 19, Pub: IBSN: ISBN: ISSN: 0044-2658
41 - Iron Ores, Beneficiation, Grinding (Comminution), Grinding Mills, Liners, Mechanical Properties

2160.17 Scales, Marilyn, "Dickenson Expansion Reduces Milling Costs"; CAN MIN J, Vol. 104, No. 6, June 1983, pp. 30, 33-34; ISSN 0008-4492; CAMJA

1 - Gold Ore Treatment - Ontario A533; A911

Expansion of mill capacity to 700 TPD involves three major changes to reduce costs: greater leaching capacity, redesign of the grinding circuit and improved throughput of the crushing plant.

2160.20 Faulkner, B.P.; Rimmer, H.W.; Grayson, Martin (ed.); Eckroth, David (Ed.) (Allis Chalmers Corp. USA (US)), Kirk-Othmer Encycl. Chem. Technol., 3rd EC., Vol. 21, 1983, pp. 132-62 37Asa Pub: Wiley, New York, N.Y.

CA148000: Review Size Redn

Size Reduction, Size Reduction Apparatus

2160.27 Ramsey, T.L., "Reducing Grinding Costs: The Potential is Great"; World Min., Vol. 35, No. 10, Oct. 1982, pp. 78-81 Pub: IBSN; IBSN; ISSN 0043-8707

41, Economics, Grinding (Comminution), Energy Conservation, Grinding Mills

Grinding is usually the most costly unit operation in mineral processing. The advantages of autogenous and semi-autogenous grinding and the economics of pilot plant testing are discussed with examples of mill circuitry. As data accumulates, the need for expensive testing is likely to diminish, at least for semi-autogenous grinding. Limits to rod/ball mill dimensions are briefly queried. Angular spiral linings and Kopper's Tower Mill both promise substantial power savings comapred with conventional ball mills.

2160.28 Woody, R., "Cutting Grinding Costs"; World Min., Vol. 35, No. 10, Oct. 1982, pp. 76-77

2160.34 Lusche, M., "Construction of the Coal Grinding Plant at the Geisingen Cement Plant and Early Operation Experience/Bau und Erste Betriebserfahrungen mit der Kohlenmahlanlage im Zementwerk Geisingen"; Zement Kalk Gips, Ed. B, Vol. 36, No. 7, July 1983, pp. 391-396; 6 Refs; ZKGBD

1 - Grinding Mills - Ball Milling; Cement Plants - Kilns; Kilns - Rotary; Pulverized Coal A 533; A802; A402; A412; A642

A central grinding plant for non-inert operating conditions, equipped with a roller mill, was built. The rotary kiln and three hot gas producers for the drying of coal, raw material and clay are supplied with pulverized coal. The choice of grinding system, the

structure of the plant and the experience in operating it are discussed. In German with English abstract.

Malghan, S.G., "Ultrafine Grinding and Separation of Industrial Materials"; American Institute of Mining, Metallurgical and Petroleum Engineers Inc., 1983.

Contains 15 papers presented at the 112th AIME meeting, Atlanta, GA.

Book Canmet Libr. 660-2842 V47

1983 (B) Crushing

2028 Robertson, Joseph L., "Concrete Recycling Uses Standard Crushing Equipment"; Rock Prod., Vol. 85, No. 9 Sept. 1982, pp. 45-46, 48, 50; ISSN 0035-7464; ROPRA

1 - Concrete - Recycling; Crushing and Grinding A412; A533

Conventional aggregate crushing equipment and tehniques are being used in recycling 124 acres of abandoned runways of the former greater southwest airport near Ft. Worth, Texas. Believed to be one of the largest concrete recycling jobs ever undertaken, the project is the forerunner to site preparation for the centreport development and will call for the removal, crushing and sizing of 585,000 sq. yds. of concrete. About 60,000 tons of the recycled material will be used in the centreport project with the remainder being sold to outside contractors, mainly for use as pipeline bedding and base material.

2036 Dippenaar, A.P.; Esterhyusen, C.O., (Iscor Pretoria South Africa), "Operating Experience with a Mobile In-pit Crushing System at Grootegeluk Coal Mine"; South African Mechanical Engineer, Vol. 32, No. 11, 1982, pp. 312-319; Ref: 000

2042 Kok, HG. (Treadwell Corp. New York, NY, USA), "Use of Mobile Crushers in the Minerals Industry"; Min Eng (Littleton, Colo.), Vol. 34, No. 11, Nov. 1982, pp. 1584-1588; 10 Refs. ISSN 0026-5187; MIENA

1 - Ore Treatment - Crushing and Grinding; Conveyors - Belt; Mobile Crushers A533; A692; A602

The continuous increase in energy costs has made it necessary to consider a broader use of belt conveyors for the transportation of material from the mine pit to the processing plant. Systems are in the planning stage for mining hard rock, such as copper and iron ore by using high-capacity, mobile or semi-portable crushers. The mobile crusher is located in the pit, and the crushed material is transported by energy-efficient, shiftable belt conveyors out of the pit.

2054 Zdenko, C.A., (Ljubija Rmk Zenica Iron Ore Mine, Omarska Prijedor Complex Oma Rska Yugoslavia); E&MJ - Engineering and Mining Journal, Vol. 186, No. 7, 1985, pp. 38-41, Ref: 000

2070.04 Boriskin, I.K.; Bykov, M.S.; Gubanov, V.I.; Permyakov, A.A.; Pyatnitskii, V.N.; Karpenko, M.I; Bragin, Y.S.; Fedorov, V.G., (S Ordzhonikidze Met Inst Novokuznetsk USSR), "Mechanical Treatment of Sinter Using Rotary Crusher with Inertial Impact Action"; Steel in the USSR, Vol. 12, No. 4, 1982, pp. 144-146; Ref: 012

2070.08 Rogers, R.S.C. (Kennedy Van Saun Corp, Danville, PA 17821), "The Double-Roll Crusher Model Applied to a 2 - Component Feed Material"; Powder Technology, Vol. 35, 1983, pp. 131-134; Ref: 006

2070.13 Anon. "In-Pit Crushing Draws Attention of Cost-Conscious Mine Operators"; Eng. Min. J., Vol. 184, No. 1, Jan. 1983, pp. 65-67; ISSN-0095-8948; ENMJA

1 - Mines and Mining - Open Pit; Crushers - Applications A502; A533; A802

The potential economic advantages to be gained by placing movable primary crushers in the pits of open-pit mines are discussed with emphasis on some conceptual developments in portable crushing systems. Recent studies are reviewed to show that portable crushers suggest a possibility of achieving marked reductions in overall mining costs.

2070.22 Hamida, A.A.; Youssif, A.; Abuhijleh, I.,(Univ Mississipi University MS 38677) "Self-Tuning Regulator of an Ore Crusher"; In: Kirk De. Conference Record - Eighteenth Asilomar Conference on Circuits, Systems Computers, 1985. pp. 312-316, Ref. 000 Pub: I E E E, Computer SCC PR; 10662 Los Vaqueros Circle; Los Alamitcs; CA90720;

18th Asilomar Conference on Circuits, Systems & Computers, Held: Pacific Grove, CA; 84/11/5-7

ISBN: C-8186-C673-E

2108 Otsuka, Kazuo; Miyakoshi, Hiroshi; Hiroshi, Sato, Isamu, Sato; Iwai, Hajime, (Akita Univ. Mining Coll, Akita City, Jpn), "Size Distribution Characteristics of Crushing Fragments - Fundamental Study on Rock Blasting"; Nipon Kogyo Kaishi, Vol. 97, No. 1121, July 1981, pp. 521-526; ISSN 0369-4194; NIKKA

1 - Mortar - Blasting; Roch Mechanics A412; A483; A502

Reported are the results of the experiments on crushing of uniform size cubic blocks made of cement mortar. Rosin-Rammlar-Bennt diagrams of all blasting fragments were found to consist of straight lines, so it was admitted that the size distribution of fragments may be characterized by Rosin-Rammlar distribution function. With constants which were found from lines for each fragment, namely the size distribution constant (n) and the absolute size constante (DE) mean particle size (DP) and specific surface area (SW) were calculated. Also the formulas were found for the relation between the mean particle size and charge depth (W). And the relation between the specific surface area ratio and charge depth. In Japanese with English abstract.

2119 Siegert, Hans, "Use of Hammer Mills for Crushing and Drying of Coal and Similar Material/Einsatz von Hammermuehlen fuer die Zerkleinerung und Trocknung von Kohle und Aehnlichen Produkten"; Sprechsaal, Vol. 115, No. 6, June 1982, pp. 525-531; ISSN 0584-9632; SPREA

1 - Crushers - Applications; Coal Pulverizers; Hammer Mills; A533; A802; A524

For its different uses, coal is required in varying degrees of fineness with varying moisture contents. It can be said that the swinging hammer mill, together with its precedessor, the fixed hammer mill, is undoubtedly the most extensively used system for crushing coal. With today's hammer mills, practically any fineness of coal can be achieved, together with corresponding degrees of drying. In German with English abstract.

2127 Anon. "Mammoth In-Pit Crusher for Sishen Ore Mine"; Steel Times Int., Vol. 7, No. 1, March 1983, pp. 53-54; ISSN 0143-7798; STTID

1 - Iron Mines and Mining - South Africa; Crushers;

Mines and Mining - Energy Conservation A504; A533; A901

A 6000T/HR semi-mobile iron ore crusher has been installed following feasibility studies at the Sishen Iron Ore Mine of the South African Iron & Steel Industrial Corporation Ltd. (ISCOR). This will allow a conveyor belt to replace trucks as a means of transporting the ore and result in energy savings.

2137 Robertson, Joseph L. (Rock Products, Chicago, Ill., USA), "Impact Crusher Replaces Three Comrpession Crushers in Plant"; Rock Prod., Vol. 86, No. 5, May 1983, pp. 44-46; ISSN 0035-7464; ROPRA

1 - Sand and Gravel Plants - Crushing and Grinding A505; A533

Crushing a wide variety of rock types into approximately 10 different sizes requires a durable, versatile crusher. At Scapoose Sand an Gravel Co., Scapoose, Oregon, a centrifugal impact crusher has replaced three compression-type crushers and produces 225 TPH of 1/2-in. or larger fractions. Since it was intalled in 1979, the one centrifugal impact crusher has done the work of a 5 1/2 ft cone and two roll crushers. The new impact crusher produces a cubical product, whereas the compression type crushers (the cone and roll units) frequently turned out a slivered "Arrow-head" shaped fragment.

2138 Rogers, R.S.C.; Shoji, K. (Kennedy Van Saun Corp. Danville, PA, USA), "Double-Roll Crusher Model Applied to a Full Scale Crusher"; Powder Technol., Vol. 35, No. 1, May-June 1983, pp. 123-129; 4 Refs.; ISSN 0032-5910; POTEB

1 - Crushers - Models A802

A model for double-roll crushers was demonstrated for a laboratory scale crusher having rolls of 200 mm diameter. The applicability of the model for an industrial scale crusher having rolls of 0.76 m diameter was investigated. Results of the study show that the model is valid for the large scale crusher over a wide range of operating conditions including variations in feed material size, crusher roll speeds, gap settings and roll surface configurations.

2139 Rogers, R.S., "The Double Roll Crusher Model Applied to a Two Component Feed Material"; Powder Technology, Vol. 35, No. 1, May-Jun 1983, pp. 123-129.

2147 Iles, Calvert D. (Duval Technology, Engineering & Construction Co., Tucson, Ariz. USA), "Costs of In-Pit Crushing"; Min. Eng. (Littleton, Colo.) Vol. 35, No. 4, April 1983, pp. 319-321; ISSN 0026-5187; MIENA

1 - Mines and Mining - Crushing and Grinding A502; A504; A911; A533

Duval Corp. has historicaly been sensitive to mining costs, in part because of relatively low grade copper-molybdenum ore obdies. These concerns have resulted in three haulage system generations at the 218 KT/D (240,000 STPD) Sierrita-Esperanza open-pit mine, Tucson, Ariz. Studies indicate an average haulage cost savings of 32 cents/T (29 Cents/St) of Rock processed through the portable system. With three portable crushing non-capital cash flow (before taxes) will increase more than 12 million. In addtion, average truck requirements will be reduced by 37P, eliminating all truck capital expenditures over the next 10-year period.

2148 Frizzel, Earl M.; Utley, Ronald W. (US Bureau of Mines, Spokane Research Cent., Spokane, Wash., USA), "USBM Designs In-Pit Movable Crusher Based on Mine Personnel Survey"; Min. Eng. (Littleton, Colo.), Vol. 35, No. 4, April 1983, pp. 317-321; ISSN 0026-5187; MIENA

1 - Crushers - Design A533; A911

Results of a mine survey in the copper, iron and molybdenum industries led to the design and refinement of a moveable crusher system. Crusher system weights, costs and worker-hour erection estimates are shown. Studies are under way to evaluate and plan integration into existing mines and new mines.

2152 Huss, Conrad, "Cost Considerations for In-Pit Crushing-Conveying Systems"; Bulk Solid Handl., Vol. 2, No. 4, Dec. 1982, pp. 753-756; 3 Refs.; BHSAD
1 - Materials Handling; Mines and Mining - Open Pit; Conveyors A691; A502; A692

This article focuses on continous materials handling systems used in the hard rock open-pit mining industry. Gudelines for mine planning with continuous systems are outlined. Key parameters affecting capital and oeprating costs are identified. Commonly encountered trade-offs between operating and capital costs are discussed. A typical range of costs is presented based on average operating conditions.

2160.00 Anon. "FOSKOR Pioneers a Mobile Crusher and Studies Dry Recovery of P//20//5."; Eng Min J., Vol. 183, No. 11, Nov. 1982, pp. 128-131; ISSN-0095-8948; ENMJA

1 - Phosphate Deposits - South Africa; Phosphate Ore Treatment - Crushing and Grinding A 505; A533

The South African Phosphate Development Corp. Ltd. (FOSKOR) put into operation a new 2,700-T/hr, self-contained, mobile crusher, operating on stock-piled mine-rune phosphate ore. The mobile plant, with its associated conveyor lines, is viewed as one of the forerunners of heavy-duty, in-pit crushers. On the processing side, FOSKOR is piloting a new flowsheet scheme designed to utilize the paramagnetic properties of its ores. If successful, the dry process could trim water consumption, save fuel for drying wet concentrates and cut flotation reagent.

2160.01 Anon. "Crusher Surface Re-building: Hardfacing Hints for Maintenance Programs"; Pit Quarry, Vol. 75, No. 4, Oct. 1982, pp. 54-59, 61; ISSN 0032-0293; PIQUA

1 - Quarries and Quarrying - Crushing and Grinding A502

Restoration, improvement and maintenance of various types of crushers, including gyratory and cone crushers, are briefly explained. Crusher base metals are examined in terms of heat treating, welding, and hardfacing, and buildup guidelines are given for crushing surfaces affected by wear.

2160.03 Robertson, Joseph L.; Bye, Roy P. (International Technical Services, Rexnord), "Glory Holes and Underground Crushers Cut Trucking Costs"; Rock Prod. Vol. 86, No. 1, Jan. 1983, pp. 36-37, 92; ISSN 0035-7464; ROPRA

1 - Crushed Stone Plants - Limestone - Japan A412; A414; A482

Gravity is used to supply raw material to a pair of underground primary crushers at Japan's largest limestone quarry. The result is drastically reduced trucking and energy costs for the ISA Cement Factory, a unit of the cement division of UBE Industries. Located in the west-central part of Yamaguchi Prefecture, the mountaintop quarry is mined in a series of benches. The raw material is dropped down two 20-ft diam. shafts of "glory holes" to feed the primary crushing circuit. Each of the shafts supplies the crusher and the use of the shafts has reduced the cost of moving the stone

from the muck pile to the first crushing stage to approximately 38 yen, about 1/7th the cost of trucking the material down the mountainside to the secondary processing level.

2160.05 Almond, R.M., (MT States Engineers, Tucson, Ariz. 00000), "A New Movable Gyratory Crusher System for Open-Pit Mines"; Revue du Practicien, Cim Bulletin, Vol. 33, Vol. 76, No. 32, No. 851, 1983.pp. 1696-1697, pp. 175-176; Ref: 000

2160.07 Benecke, K.J. (Krupp Industrie und Stahlbau, West Ger.), "In-Pit Crushers and the Economics of In-Pit Crushing"; S. Afr. Mech. Eng., Vol. 32, No. 11, Nov. 1982, pp.308-311; ISSN 0038-2442; SAMEA

1 - Coal Preparation - Crushing and Grinding; Coal Mines and Mining - South Africa A524; A911; A503

This study shows that in South African coal strip mines semi-mobile in-pit crushing is always applicable for production rates beyond 10 MT/A of coal. For production rates between 5 and 10 MT/A in-pit crushing should be investigated if the relation of surface transport distance (M) to lifting height (M) is less than 100.

2160.08 Dippenaar, A.P.; Esterhuysen, C.O., (South African Iron & Steel Corp., Pretoria, S. Afr.) "Operating Experience with a Mobile In-Pit Crushing System at Grootegeluk Coal Mine"; S. Afr. Mech. Eng., Vol. 32, No. 11, Nov. 1982, pp. 312-319; ISSN 0038-2442; SAMEA

1 - Coal Preparation - Crushing and Grinding; Coal Mines and Mining - South Africa A524; A503; A911

This paper is an evaluation of the mobile in-pit crushing system at ISCOR's Grootegeluk Coal Mine which was commissioned in July 1981. Special reference is made to some engineering aspects of the system components, operating practice and economic appraisal of the system.

2160.14 Gainieva, G.R.; Sokolova, T.I. (Western Siberian Iron & Steel Works, USSR), "Increasing the Level of Coal Charge Crushing"; Coke Chem (USSR), No. 8, 1982, pp. 1-3; 4 Refs.; ISSN 0010-0501; COKCA

1 - Coal Preparation - Breakage; Crushing and Grinding; Coke Manufacture; Coke Plants A524; A533; A802

An important factor in the production of high quality coke is the preparation of the coal charges for coking,

particularly the degree of their crushing. This factor affects the caking and coke formation processes, and the bulk density and quantity of charge in coke battery ovens. Coking plants are now successively increasing the level of charge crushing, in a number of cases using differential and selective crushing. According to available data, in the RSFSR the greatest degree of crushing (80-82P of the below 3 mm class) is the Kuznetsk and Western Siberia Iron and Steel Works (I&SW). Other plants using charges containing Kuznetsk coal have a crushing level in the 65-78P range. It is shown by experimental data that the larger size classes in the charges (over 6 mm) are characterized by high ash and low volatile matter and content of caking components. With an increase in the level of crushing of the charge the coke structural strength and abradability are impaired insignificantly. The effect of the degree of crushing of the charge on the strength of the coke by the P25 index is not significant.

2160.18 Dippenaar, A.P.; Esterhuysen, C.O.; De Wet, N. "Mobile In-Pit Crushing System for Overburden at ISCOR's Groote Geluk Coal Mine"; Bulk Solid Handl., Vol. 3, No. 1, March 1983, pp. 21-30; BHSAD

1 - Coal Mines and Mining - Open Pit A503

In this paper the mobile in-pit crushing system for overburden, which was commissioned in July 1981, at ISCOR's Grootegeluk coal mine, is described. Special reference is made to some engineeering aspects of the system components, operating pracice and an economic appraisal of the system.

2160.19 Neff, Dan; Huss, Conrad, "Finite Element Structural Analysis of Movable Crusher Supports"; Bulk Sold Handl., Vol. 3, No. 1, March 1983, pp. 49-54; BHSAD

1 - Mines and Mining - Open Pit; Structural Analysis A502; A931

Finite element analysis is applied to two different basic structural arrangements. One configuration utilizes a plate shell structure to carry the loads similar to the construction used for the marine industry. The other configuration utilizes a space frame made up of columns, beams and bracing similar to the construction used for buildings. Both static and dynamic analysis are carried out for the two configurations.

1983 - (C) Grinding

1983 Grinding (i) Ball and Roller Mills

2009 Kuseman, Von K.; Trommler, G.; Herrman, R.; Dombrowe, H. "Balls and Clypebs - A Comparison/Zum Vergleich Kugel - Zylpebs"; Zement Kalk Gips, Vol. 35, No. 11, pp. 602-608 In German with English and French Summaries

2052 Anon. "Forged Grinding Ball Manufacture in USA"; Min. J., Vol. 299 (7684), 26 Nov. 1982, p. 381

95 - Grinding Mills, Spheres, Forgings

Marathon Steel Co. of Phoenix, Arizona, USA commenced the manufacture of forged steel grinding balls in October 1982 at a new facility at the company's rolling mill in Temple, Arizona. The new plant also extends Marathon's finished steel production capacity. The plant is designed to produce about 25,000 TPY of heat treated, forged grinding balls. Details of the plant and testing facilities are outlined.

2055 Rose, H.E.; Matsumura, S., (Univ. London Kings Coll. London, WC2R 2LS, England), "Simultaneous Grinding of 2 Materials in a Batch Ball-Mill"; Transactions of the Institution of Mining and Metallurgy Section C-Mineral Processing and Extractive Metallurgy, Vol. 94, March, 1985, pp. 40-46; Ref: 004

2070.27 Stehr N.; Schwedes, J. (Tech. Univ. Burnswic, Inst. Nech. Verfahrenstech D-3300 Brunswick Fed Rep Ger) "Studies on Size-Reduction in an Agitator Ball Mill"; Chemie Ingenieur Technik., Vol. 55, No. 3, 1983, p. 233; Ref: 000

2070.38 Ramamurti, V.; Prasad, N.S. (Indian Inst. Technol. Madras 600036 Tamil Nadu India), "Stress-Analysis of Ribbed Tube Mills"; Zement Kalk Gips, Vol. 36, No. 2, 1983, pp. 65-74; Ref: 000

2070.44 Freiermuth, D.; Kirchner, K. (Dechema Inst. Postfach 970146 D-6000 Frankfurt 97 Fed. Rep. Ger.) "A Contribution to the Experimental Determination of Ball Rotation Time in Ball Mills"; Chemie Ingenieur Technik., Vol. 55, No. 1, 1983, pp. 60-61; Ref: 006

2132 Howat, D.D.; Wright, G.J. "The Potentiality of Heat Treated Balls in the Grinding of Gold Cres." (Pamphlet); Rept. Mintek Rep. No. M101, 1983, p. 10;

Pub: Council for Mineral Technology, 200 Hans Strijdom Randburg, South Africa

31, Ball Mills, Service Life, Carbon Steels, Mechanical Properties, Wear Rate, Comminution

A major investigation was made of the life and performance of heat treated grinding balls in the 9 x 10 ft. no. 1 ball mill at Libanon gold mine. The standard 100 mm cast semisteel balls commonly used to grind Au ores are not suited to heat treatment. The composition was therefore altered so that suitable hardening and tempering would give the balls a Brinell hardness of 550 to 600 as against the 330 to 380 of the standard balls. During a 24 week test, 160 tons of these heat treated balls containing 0.4-0.7% CR and 0.6-0.9% carbon were added to the mill. The performance of the balls, which was monitored at weekly intervals, showed an improvement of 27% over that of the standard balls. A technique was developed that permitted rapid determination of the average DIA of the balls within the mill. These results were correlated with the fineness of the grind (as measured by the harmonic mean size of the product), the power consumption, the volume of the grinding charge in the mill and the rate of addition of the balls.

2146 Feige, F.; Gollnast, W. "Research on the Dynamic Effect of Grinding Media Motion in Tube Mills upon the Drive System/Untersuchungen zum Dynamischen Einfluss der Mahlkoerperbewegung von Ruhrmuehlen auf das Antriebssystem"; Zem Kalk Gips Ed. B., Vol. 35, No. 11, Nov. 1982, pp. 587-593; 12 Refs.; ZKGBD

1 - Grinding Mills - Ball Milling; Crushing and Grinding; Mathematical Models A533; A802; A921

The authors report on research conducted with the object of investigating the motion of the grinding balls in a tube mill as a possible excitation mechanism or as the cause of torsional vibrations in the drive system. The investigations were based on a mathematical model on tests performed in a laboratory mill with all parameters adjustable. In German with English abstract.

2160.16-B McIvor, R.E. (Linatex Canada Inc., Montreal, Que. Can), "Effects of Speed and Liner Configuration on Ball Mill Performance"; Min. Eng. (Littleton, Colo.) Vol. 35, No. 6, June 1983, pp. 617-622; 26 Refs.; ISSN 0026-5187-; MIENA

1 - Grinding Mills - Ball Milling A533

The factors that affect ball mill energy efficiency are reviewed and attention is focused on the mechanisms of grinding. The trajectory of the outer row of balls with different lifting face angles is derived. Basic recommendations for mill speed and liner configuration are also presented.

2160.44 Freiermuth, Dieter; Kirchner, Kurt (Dechema Inst., Frankfurt Am Main, West Ger.) "Ball Energy Distribution in Ball Mills as a Function of Grinding Parameters"; Ger. Chem. Eng., Vol. 6, No. 2, March 1983, pp. 98-104; 11 REFS; ISSN 0343-5539; GCETD

1 - Grinding Mills - Ball Milling A523

Energy transfer from grinding balls to grinding stock, in the bed of a dry, batchwise operated ball mill is physical described in a parameter model. Ball circulation period, crushing of the grinding stock articles and initial comminution rate were determined experimentally and the ball energy utilizable for size reduction of the grinding stock was assessed. With the aid of the utilizable ball energy, which follows Maxwell or Boltzmann distribution, and the log normal distribution of crushing energy, the comminution process at the beginning of grinding can be resolved into comminution steps of individual balls. In analogy to chemical reactions, a comminution step can be subdivided into an energy and an impact term and represented as function of the grinding parameters.

1983 Grinding (ii) Autogenous, Semi-Autogenous, Pebble Mills

2016 Bassarear, John H. (Fluor. Min. & Met. Inc. Redwood City, Calif. USA) "Semiautogenous vs. Conventional Steel Consumption at Cyprus Pima"; Min. Eng. (Littleton, Colo.), Vol. 34, No. 8, Aug. 1982, pp. 1244-1247; 3 Refs; ISSN 0026-5187; MIENA

1 - Copper Ore Treatment - Crushing and Grinding; Grinding Mills; Crushers A533

A 13.6 KT/D (15,000 TPO) expansion was put onstream late in 1971 using primary crushing, semiautogenous mills, and ball mills. Identical ore is treated in both concentrators. This paper shows the weight and life of each liner for each crusher and mill from 1974-1977. Media consumption is shown and a comparison is made between the two reduction methods.

2070.19 Anon. "Grinding Mills - Rod, Ball and Autogenous"; Min. Mag., Vol. 147, No. 3, Sept. 1982, 12 p. between pp. 197 and 225; ISSN 0462-6230; MMALA

1 - Grinding Mills A533

This article summarizes makes and types of grinding mills in which rods, balls, coarse ore lumps or other media are rotated and tumbled in a cylinder with the material to be ground.

2070.25 Rahter, Jim (Paul O Abbe Inc. Little Falls, NJ 07424), "Redesign of Laboratory and Production Ball-and-Pebble Mills to Meet Changing Safety and Plant Requirements"; In: Smothers, W.J; Robb S.C., Ceramic Engineering and Science Proceedings. Vol. 3, No. 11-12, 1982, pp. 849-857; Ref: 000; Pub: Amer. Ceramic. Soc.; 65 Ceramic Drive; Columbus, OH 43214

Bath Annual Meeting of the Whitewares and Materials and Equipment Divisions of the American Ceramic Soc. Held: Cincinnati, Ohio, 82/5/2-5

LC: 79-26910 IBSN: 0-12-181991-4

2160.16A Iwasaki, I; Reid, K.J.; Lex, H.A.; Smith, K.A. "Effect of Autogenous and Ball Mill Grinding on Sulfide Flotation"; Min. Eng. (Colorado), Vol. 35 (8), Aug. 1983, pp. 1184-1190; Pub: IBSN: IBSN: ISSN 0026-5187

41. Copper Ores, Beneficiation, Nickel Ores, Autogenous Mills, Ball Mills, Grinding (Comminution)
The effects of autogenous grinding and conventional grinding on the floatabilities of copper - nickel sulfides from Duluth Gabbro were investigated. At the same mesh-of-grind Cu, Ni and Co recoveries were higher and residual sulfur in the flotation tailings was lower with the autogenously ground pulps. With the ball-mill ground pulps the residuals in the tailings could not be lowered to the level attained by the autogenously ground pulps even at increased levels of the collector addition. From mineralogical examinations of concentrate and tailings samples, an electrochemical interaction between grinding media and sulfide minerals was thought to have a greater effect on sulfide mineral flotation behavior than the breakage characteristics of the ore samples in these two types of mills. 13. ref.

1983 Grinding (iii) Tower Mills, and Other Grinding

2002 Mohanty, B.; Narasimhan, K.S. (Reg. Res. Lab. Bhubaneswar, India), "Fluid Energy Grinding"; Powder Technol., Vol. 33, No. 1, Sept-Oct. 1982, pp. 135-141; 18 Refs.; ISSN 0032-5910: POTEB

1 - Grinding Mills - Performance; Fluid Energy Mill A802

The performance of a typical fluid energy mill with respect to the rate of grinding of different materials has been studied. For the materials studied in the experiments, it was observed that there exists an optimum feed rate for each material where size redution is maximized. It has further been possible to evolve an empirical relationship between the rate of grinding and the rate of new surface area created.

2014 Nied, R., (Augsburg, Fed. Rep. Ger. (DE)), "Fluidized Bed Counter-Jet Mill - Recent Findings and New Applications"; Aufbereit.-Tech., Vol. 23, No. 5, 1982, pp. 236-42; ISSN 0004-783X; AUFTA

CA154001: Jet Mill Fluidized Bed, Grinding Jet Mill Selective, Mineral Grinding Jet Mill Selective, Sand Grinding Jet Mill, Pigment Grinding Jet Mill Selective

Sand, Size Reduction Apparatus, Ore Treatment, 7782-42-5; 1344-28-1; 409-21-2

2023 Henz, F., "Operating Experience with a Roller Mill for Coal Grinding/Betriefserfahrungen mit Einer Rollenmuehle zur Kohlemahlung"; Zem Kalk Gips Ed. 8, Vol. 35, No. 8, Aug. 1982, pp. 398-403; 1 Ref.: ZKGBD

1 - Grinding Mills - Ball Milling; Coal Handling; Coal Preparation; Coal Pulverizers A533; A524; A691

The conversion from oil to coal firing is described. Handling and conveying the raw coal are dealt with. Operating experience with the mill, automatic starting and stopping of the plant, and operating costs are also considered. The pulverized coal feed regulating arrangements and combustion are discussed. In German with English abstract.

2041 Meintrup, Walter; Kleiner, Fritz (Siemens, Erlangen, Ger.) "World's Largest Ore Grinder Without Gears"; Min Eng (Littleton, Colo.) Vol. 34, No. 9, Sept. 1982, pp. 1328-1331; ISSN 0026-5187; MIENA

1 - Iron Ore Treatment - Crushing and Grinding A533

This article examines reasons for selecting this type of drive over more conventional schemes, lists specific advantages of such large mills, and describes the installation at an iron ore mill in Norway.

2051 Martynyuk, M.M. (Univ. Drjzhb. Nar. Im. Patrice Lumumba, Moscow, USSR (SU)), "Breakdown of Solid Media by a Jet of Metastable (Superheated) Water"; Fix.-Tekh. Probl. Razrab. Polezn. Iskop., No. 4, 1982, pp. 45-50; ISSN 0015-3273; FTRIA

CA158011; Jet Superheated Water Rock Crushing

Jets, Mines and Mining, Minerals, Rocks

2053 Lloyd, P.J.D.; Bradley, A.A., Hinde, A.L.; Stanton, K.H.; Schymura, G.K. (Chamber of Mines Res. Organ, Johannesburg, S. Afr.) "Full-Scale Centrifugal Mill"; J. S. Afr. Inst. Min. Metall., Vol. 82, No. 6, June 1982, pp. 149-156; 7 Refs.; ISSN 0038-223x: JSAMA

1 - Ore Treatment - Crushing and Grinding A533

The machine is capable, in the autogenous mode, of grinding more than 25 T/h of minus 75 plus 44 mm hard quartzite to a minus 3 mm product containing over 50 percent minus 75 μm material, and as a ball mill of grinding more than 60 T/h of minus 19 mm quartzite to a minus 3 MM product containing over 35 percent minus 75 μm material. Extrapolation of computer models suggests that these limits can be exceeded.

2070.05 Uhlmann, J.; Kranepohl, D. "Raw Grinding Plan with Twin-Rotor Impact Pulverizing and Drying Mill at the Sharr Cement Works in Yugoslavia"; Zement Kalk Gips, Vol. 36, No. 5, 1983, pp. 281-287, Ref: 000

2070.11 Sabaski, R.E. (Allis-Chalmers Corp. USA), "Grinding Mill Drives - Systems, Challenges, Considerations"; Min. Eng. (Littleton, Colo), Vol. 35, No. 1, Jan. 1983, pp. 43-47; 5 Refs. ISSN 0026-5187; MIENA

1 - Grinding Mills - Selection A533

This paper discusses the considerations involved and decisions which must be made by the buyer, mill manufacturer and vendor during the proposal and ordering stages. Interrelations between the mill manfuacturer and the gear vendor, application of AGMA

standards, how drive standards and speciications are refined through steady-state and computer simulated torsional analyses are included along with correlational field testing.

2070.14 Lloyd, P.J.D.; Bradley, A.A.; Hinde, A.L.; Stanton, K.H.; Schymura, K. (Chamber of Mines Res. Org. S. Afr), "Centrifugal Grinding on a Commercial Scale"; Eng Min J Vol. 183, No. 12, Dec. 1982, pp. 49-54; 7 Ref.; ISSN 0095-8948; ENMJA

1 - Ore Treatment - Crushing and Grinding; Grinding Mills A533

Long term continuous testing has proved that comminution in a centrifugal grinding mill is more rapid than in a conventional ball mill, and the size of machine needed for a given grinding duty is thus reduced. A smaller size mill would cost less to build and install, and maintenance would be simpler. The production size unit has been campaigned extensively in autogenous and ball mill modes at a test module at an active gold mine.

2070.18 Summers, W. (Sweco Inc. Florence KY 41042', "Broad Scope Particle Size Reduction by Means of Vibratory Grinding"; In: Smothers. W.J.; Robb S.C., Ceramic Engineering and Science Proceedings, Vol. 3, No. 11-12, 1982, p. 888; Ref.: 000 Pub. Amer. Ceramic Soc; 65 Ceramic Drive, Columbus, Ohio 43214

84th Annual Meeting of the Whitewares and Materials and Equipment Division of the American Ceramic Society Held; Cincinnati, Ohio, 82/5/2-5

LC: 79-26910 ISBN: 0-12-181991-4

2070.39 Unger, W., "Centrifugal Mills and Roller Mills - A Comparison"; Zement Kalk Gips, Vol. 36, No. 2, 1983, pp. 57-62; Ref: 000

2070.41 Wessel, H.F. (Hannover Fed. Rep. Ger. (DE)), "Quality Characteristics of Cements Ground in a Roller Mill"; Zement Kalk Gips, Ed. B, Vol. 35, No. 8, 1982, pp. 425-31; ISSN 0341-0560; ZKGBD

CA158001; Cement Property Rolling Grinding

Cement

2117 Johnson, J.; Szegvari, A.; Li, M., "Attritor Grinding and Dispersing Equipment"; Polym., Paint. Colour J., Vol. 172, No. 4075, 1982, pp. 459-460, 463; ISSN 0370-1158 PPCJA

CA147006; Attritor Grinding Dispersing App

Size Reduction, Dispersion, Size Reduction Apparatus

2118 Bezborodkov, S.M.; Bykov, V.V.; Letin, L.A.; Roddatis, K.F., "Coal Grinding Mills Made by Syzran Turbomachinery Plant/Ugle Razmol'Nye Mel'nitsy Syzranskogo Turbostroitel'Nogo Zavoda"; Energomashincstroenie, No. 5, May 1982, pp. 40-43; ISSN 0013-7456; EGMSA

1 - Coal Pulverizers; Grinding Mills A524

Coal-grinding mills made at the Syzran turbomachinery plant in Kuybyshev region, their technical characteristics and operational data are described. Problems of reliabilty, efficiency and repairability of the mills are considered. The present state of the art and prospect of development of coal-grinding equipment are discussed. In Russian.

2140 Arastoopour, H.; Chen, C.Y. (IIT Inst. Gas Technol. Dept. Gas Engn. Chicago, IL 60616) "Attrition of Char Agglomerates"; Powder Technology, Vol. 36, No. 1, 1983, pp. 99-106; Ref.: 015

2143 Unger, W. "Centrifugal Mills and Roller Mills: A Comparison/Gegenuebers Tellung von Pendel und Schuesselmuehlen"; Zement Kalk Gips Ed. B, Vol. 36, No. 2, Feb. 1983, pp. 57-62; 21 Refs.; ZKGBD

1 - Grinding Mills; Crushing and Grinding; Cement - Manufacture A633; A802; A412

The article presents qualitative comparisons between a number of general properties of centrifugal mills (ring-roller mills in which the rollers are pressed against a vertical grinding ring by centrifugal force) and roller mills (in which the rollers run on a horizontal grinding ring). The design features, construction and mode of operation of the centrifugal mill and the general characteristics of roller mills are described. In German with English abstract.

2144 Ackle, W. "New Drive System with Planetary Gearing for Roller Mills"; Zement Kalk Gips, Vol. 36, No. 2, 1983, pp. 87-91, Ref.: 000

2160.36 Solazzi, Monte, J. (Chemplex Ind., Inc., USA (US)), "An Investigation of the Performance of Comminution Vials and Ball Pestle Impact Grinders"; Am. Lab. (Fairfield, Conn.), Vol. 15, No. 10, 1983, pp. 63-64, 66, 68-70, 72-4; ISSN 0044-7749; ALBYB

CA147006; Comminution Vial Ball Pestle, Impact Grinder Ball Pestle Vial

Size Reduction

2160.38 Leimann, D.O. (Fritz Sauerwald D-560 0 Wuppertal Fed. Rep. Ger.), "New Possibilities for the Design of Cement and Coal Mill Gear Units with the Aid of Load Collectives"; Zement Kalk Gips, Vol. 36, No. 11, 1983, pp. 645-652, Ref. 000

2160.39 Hirt, M.; Kulzer, W. (Zahnraderfabr Renk AG D-8900 Augsburg 1 Fed. Rep. Ger.), "Large Bevel Planetary Gear Unit for 3500-KW Roller Mills"; Zement Kalk Gips, Vol. 36, No. 11, pp. 639-644, Ref: 000

2160.41 Ramamurti, V.; Sivaprasad, N.; Rayudu, G.V.N. (Indian Inst. Technol. Madras 600036 Tamil Nadu India), "Stress-Analysis of Mill Heads of Large Tube Mills"; Zement Kalk Gips, Vol. 36, No. 11, 1983, pp. 633-638, Ref: 000

1983 Grinding (iv) Wear, Liners

2022 Hoffman, K, "Ball Wear in Tube Mills"; Zement Kalk Gips, Vol. 36, No. 1, 1983, pp. 21-29; Ref: 000

Known and new wear mechanisms are systematically examined and, by the introduction of normalization, are translated into practically generally valid wear equations and diagrams. The results are exampled with the aid of some examples and suggestions to assist wear measurement are made. 12 pp. In German.

2027 De Richemond, A.L. (Fuller Co.), "Choosing Liner Materials for Ball Mills"; Pit Quarry, Vol. 75, No. 3, Sept. 1982, pp. 62-65; ISSN 0032-0293; PIQUA

1 - Ore Treatment - Crushing and Grinding A533; A 911

A list of wear-resistant irons and steels will aid the engineer in selecting the best material for each area. This list compares the relative abrasion resistance, toughness and cost of various materials.

2059 Malghan, S.G. (Exxon Miner. Co., Florham Park, NJ, USA, US)), "Methods to Reduce Steel Wear in Grinding Mills"; Min. Eng. (Littleton, Colo.) Vol, 34, No. 6, 1982, pp. 684-690; ISSN 0026-5187; MIENA

CA154000; Review Grinding Mill Steel Wear

Size reduction apparatus. 12597-69-2

2070.06 Sare, I.R., "Repeated Impact-Abrasion of Ore-Crushing Equipment"; Wear, Vol. 87, No. 2, 16 May 1983, pp. 207-225; Pub: IBSN: IBSN: ISSN 0043-1648

31, Nickel Chromium Molybdenum Steels, Mechanical Properties, White Iron, Hammers, Abrasive Wear, Impact Wear

The wear processes which occur on swing hammers used to comminute an abrasive ore were investigated. The performance of martensitic (Ni-Cr-Mo) cast steel and white cast iron hammers was studied to assist in the development of valid simulative wear tests by documentation of the mechanisms by which wear takes place in a repeated impact-abrasion application. The principal mechanism of material loss of the martensitic steel was microspalling, produced by subsurface fracture through a hard brittle white-etching layer developed at the wear surface. Wear of the white cast iron was controlled by the preferential fracture and subsequent spalling of eutectic carbides at the surface, thereby causing the brunt of the ore impacts to be borne by the secondary-carbide-enriched matrix. An explanation of the eutetcic carbide fracture process is made based on the interaction of stress waves with the constitutents of the microstructure.

2070.46 Strah, Ludwig M. (Cont. Mine Equip. Ltd. Haileybury, Ont. Can.), "Review of the History, Design and Manufacture of Rubber Mill Liners"; CIM. Bull., Vol. 75, No. 847, Nov. 1982, pp. 91-94; 5 Refs.; ISSN 0317-0926; CIBUB

1 - Ore Treatment - Crushing and Grinding A533

Rubber mill liner design is discussed in relation to present-day installations employing liners in various grinding applications. A brief overview is given of a

manufacturer's procedures to produce rubber mill liners.

2125 Vermeulen, Leon Ampeir; Howat, David Dickie (Council for Mineral Technology, Randburg (South Africa)), "Analysis of the Results of a Marked-Ball Test in Relation to Theories of Ball Wear in Rotary Mills"; PB83-220145, 8 April 1983, 36 pages (Mintek-M77; ISBN-0-86999-609-6)

131; 148; 41J; 41L 94F; *Wear, *Wear Test, *Ball Mills, Cost Analysis, *Foreign Technology, NTISTFNIM, NTISFNSF

Theories of ball wear are formulated, and it is shown that, in terms of such theories, the difficulties associated with the results of a marked-ball test (so-called because the different types of balls carry distinguishing marks) can be interpreted and resolved. This type of test is contrasted with the conventional test that is used in the evaluation of grinding balls. It is demonstrated that, in a marked-ball test, several types of ball can be evaluated simulataneously at a much lower cost, and that the results can be used for the estimation of ball consumption in a mill and for the evaluation of the cost-effectiveness of the grinding balls.

2160.12 Roylance, B.J.; Pocock, G. (Univ. Wales Univ. Coll. Swansea, Dept. Mech. Engn., Swansea SA2 8PP W. Glam. Wales), "Wear Studies Through Particle-Size Distribution .1. Application of the Weibull Distribution to Ferrography"; Wear, Vol. 90, No. 1, 1983, pp. 113-136, Ref: 012

1983 (D) CLASSIFICATION

2007 Gierslepen, G.; Richter, W. (Bayer AG D-5090 Leverkusen Fed. Rep. Ger.), "Classifiers and Sieves"; Chemie Ingenieur Technik., Vol. 54, No. 11, 1982, p. 1000; Ref: 000

2011 Widenka, R. (Data Labs. Ltd. Mitcham Surrey, England), "Measuring Particle-Size and Velocity by Laser"; Engineering, Vol. 222, No. 11, 1982, pp. 832-833; Ref: 000

2013 White, Douglas, L. (Amoco Prod. Co. (Int.), Houston, Tx, USA (US)), "Tests Show Differences in Cyclones";

Oil Gas J., Vol. 80, No. 43, 1982, pp. 151-152, 155-157; ISSN 0030-1388; OIGJA

CA151002; Drilling Fluid Silt Sand Hydrocyclone

Drilling Fluids and Muds, Silt, Sand

2015 Jenkinson, Douglas (NCB, Engl.), "Rotating Feasibility Screens"; Min. Congr. J., Vol. 68, No. 7, July 1982, pp. 29-32; ISSN 0026-5160; MCJOA

1 - Coal Preparation - Screening A524

A new concept in screening which uses rotation instead of vibration has solved the "blinding" problem caused by wet, clayey coal and has the unique ability to vary sizing during operation.

2017 Bohnet, Matthias (Tech. Univ. Braunschweig, Ger.), "Cyclone Separators for Separation of Gas/Solids Flow Systems/Zyklonabscheider zum Trennen von Gas/Feststoff-Stroemungen"; Chem. Ing. Tech., Vol. 54, No. 7, July 1982, pp. 621-630; 49 Refs.: ISSN 0009-286X; CITEA

1 - Separators; Separation; Gases; Solids A802; A931

Cyclones are used for separation of particles of solids from gas flow. Although cyclones have been in industrial use for nearly a century, it is still impossible to completely calculate the flow processes involved. This study deals with the theory of the separation process with separation behaviour, limiting particle size, generation of twist, and pressure drop. A description is given of the optimization of the cyclone by aerodynamic calculations with the separation performance, energy requirement, and investment costs as parameters. The separation performance and the energy requirements of cyclones are largely determined by the mode of construction and the operating conditions. Cyclones used industrially are discussed. In German with English abstract.

2019 Ruzbehi, M.; Alt, C.; Luecke, R. (Stuttgard, Fed. Rep. Ger. (DE)), "Studies on the Effect of Bulk Material Size in Mixing"; Aufbereit.-Tech., Vol. 23, No. 6, 1982, pp. 316-26; ISSN 004-783X; AUFTA

CA148002; Mixing Bulk Material Size

Mixing, Particle Size, Dimensionless Number, Power

2031 Edmiston, Kenneth J. (Pincock, Allen & Holt Inc., Tucson, Ariz. USA), "Sizing Operations Are Key to Comminution Circuits"; World Min., Vol. 35, No. 10, Oct. 1982, pp. 82-83; ISSN 0043-8707; WOMID

1 - Ore Treatment - Crushing and Grinding A533; A911

Accurate and efficient sizing of crushing and grinding products can increase throughput and reduce costs. This is important as capital expenditures for new capacity become more difficult to justify with low metal prices.

2037 Cameron, W.H.; Lachapelle, P.R. (Energy, Mines & Resources Canada, Mineral Processing Lab. Ottawa, Ontario, Canada), "An Empirical Method of Determining the Less than 2 Micrometer Fraction on a Leeds-Northrup Model 7991 Microtrac Laboratory Particle-Size Analyzer (1.9 to 176 Num)"; Powder Technology, Vol. 33, No. 2, 1982, pp. 277-285; Ref: 004

2038 Oakley, D.M.; Jennings, B.R.; Waterman, D.R.; Fairey, R.C. (Phys. Dep., Brunel Univ., Uxbridge, UK UB8 3PH (GB)), "An Electrooptic Birefringence Fine-Particle Sizer"; J. Phys. E., Vol. 15, No. 10, 1982, pp. 1077-1082; ISSN 0022-3735; JPSIA

CA166004; Suspension Particle Size Detn. App, Electrooptic Birefringence Fine Particle Sizer Suspensions, Electric Birefringence, Particle Size

2070.21 Austin, Terry M.; Cheremisinoff, Paul N. (Ed.) (Solvents Intermed. Div., Union Carbide Corp., South Charleston, WV, USA (USA)), "Particle Measurement Techniques"; Air/Part. Instrum. Anal., 1981, pp. 1-24; 49MDA Pub: Ann Arbor Sci., Ann Arbor, Mich.

CA15900; Review Particle Size Detn Air

Air Analysis, Particle Size

2070.28 Casal, Joaquin; Martinez-Benet, Jose M. (Chem. Eng. Dep., Polytech. Univ. Barcelona, Barcelona, Spain 28IES)), "A Better Way to Calculate Cyclone Pressure Drop"; Chem. Eng. (N.Y.), Vol. 90, No. 2, 1983, pp. 99-100; ISSN 0009-2460; CHEEA

CA148007; Cyclone Pressure Drop Calcn.

Separators, Pressure Drop

2070.34 Trawinski, H. (Amberger Kaolinwerke Bmch, Apparatebau Abt, Postfach 1140 D-8452 Hirschau Opf, Ref. Rep. Ger.), "Centrifuges and Hydrocyclones"; Revue du Practicien; Chemie Ingenieur Technik, Vol. 33, Vol. 54, No. 4, No. 12, 1983, 1982, pp. 153, pp. 1160-1169; Ref: 007

2070.36 Smigerski, H.J., "Determination of Separation Efficiency Curves in Grinding Classification/Zur Ermittlung der Trenngradkurven bei Mahlender Klassierung"; Aufbereit Tech. Vol. 23, No. 10, Oct. 1982, pp. 552-558; 4 Refs.: issn 004-783X; AUFTA

1 - Crushing and Grinding - Efficiency A533; A802

In classifying agglomerative solids of fine size, major dispersing forces are required to achieve precision of separating. However, excessively intense dispersing effects exceeding the level of mere deagglomeration may, particularly when air-separating powdery plastics, cause fragmentation of grains and generation of abraded ultrafine material. Separation of this kind may be described as classification with superimposed size reduction. This article demonstrates that the separation curves of fine grained plastics powder become ambiguous and show characteristic deviations from the customary S-curve. By applying the law of error propagation, such curves are given a firm statistical basis. In German and English.

2070.42 Williams, Michael P. (Amoco Prod. Co., Tulsa, Okla, USA), "Solids Control for the Man on the Rig - 2. Hydrocyclone and Centrifugal Pump Sizing"; Pet. Eng. Int., Vol. 54, No. 13, Nov. 1982, 5 pages between pp. 102 and 110; 4 Refs.; ISSN 0164-8322; PENGA

1 - Pumps, Centrifugal - Selection; Hydrocyclones A618

An examination is made of misconceptions relevant to hydrocyclones and methods for sizing centrifugal pumps.

2106 Cecala, Andrew B.; Volwein, Jon C.; Timko, Robert J.: William S., Kenneth L. (Bur. of Mines, Pittsburgh Research Cent. Pittsburg, PA, USA) "Velocity and Orientation Effects on the 10-mm Dorr-Oliver Cyclone"; Rep. Invest. US Bur. Mines, 8764, 1983 14 Pages; 8 Refs.; ISSN 0096-1922; XBMIA

1 - Mine Dust - Control; Chemical Equipment - Cyclones A402; A914; A802; A451

The Bureau of Mines conducted a laboratory study to investigate whether high wind speed (> 300 ft/min) or sampler inlet orientation with respect to wind direction can introduce errors when sampling respirable dust, and whether such errors can be reduced by using an inlet shield.

2017 Edmiston, Kenneth J. (Pincock Allen & Holt Inc., Tucson, Ariz. USA), "International Guide to Hydrocyclones"; World Min., Vol. 36, No. 4, April 1983, pp. 61-67; 25 Refs.; ISSN 0043-8707; WOMID

1 - Ore Treatment - Equipment; Chemical Equipment - Cyclones A533; A802

There are approximately 50 to 60 manufacturers of hydrocyclones in the world today. For the purpose of this article, the total list of suppliers includes only those who supply cyclones for mineral processing operations. Excluded wil be those designed primarily for coal processing and sewage and sludge disposal.

2114 Reid, K.J.; Voller, V.R. (Miner, Resourc. Res. Cent., Univ. Minnesota, Minneapolis, MN, USA, 5545-0205 (US), "Reconciling Hydrocyclone Particle-Size Data"; Chem. Eng. (N.Y.), Vol. 90, No. 13, 1983, pp. 43-44; ISSN 009-2460; CHEEA
CA148011; Hydrocyclone Particle Size Algorithm

Algorithm, Particle Size, Separation

2122 Bos, A.S.; Heerens, J.J. (Delft. Univ. of Technol. Neth), "Light Backscattering as a Technique to Measure Solids Particle Size and Concentration in Suspension"; Chem. Eng. Commun., Vol. 16, No. 1-6, Aug. 1982, pp. 301-311; 15 Refs.; ISSN 0098-644; CEGCA

1 - Suspensions; Particle Size Analysis; Light; Solids - Measurements; Light Backscattering A801; A804; A941; A741; A931

Measurement of high concentrations of solids in a suspension and measurement of large particle sizes (> 1 mm) in suspensions often present large problems. In this study, a new measuring technique is described. Based on light backscattering, this technique may be used for monitoring a process in which rapid and large changes in particle size occur, or for controlling processes with large concentrations of small particles. Theoretical backgrounds of the method are also presented. The measuring apparatus is described and some results are given to illustrate its possibilities.

2124 Kilmeyer, R.P., "Dense Medium Cycloning of Fine Coal at Low Specific Gravities"; 1982, 19 pages.

2160.29 Edmiston, K.J., "Size Operations are Key to Comminution Circuits"; World Min., Vol. 35, No. 10, Oct. 1982, pp. 82-83; Pub: IBSN: IBSN; ISSN 0043-8707

41, Screening (Sizing), Cyclone Separators, Comminution, Mathematical Models

Advances listed are multi-angle screens, rubber ball retention and flexed decks to reduce blinding, and use of polyurethane to reduce wear and noise. Hydrocyclone research has latterly focussed on improving simulation models, benefits derived from mathematical modelling and 2-stage cycloning and development of "choke-free" cyclones are cited.

1983 (E) THEORY, KINETICS, MODELLING, FRACTURE

2012 Boysan, F.; Ayers, W.H.; Swithenbank. J. (Sheffield Univ. Eng.), "Fundamental Mathematical Modelling Approach to Cyclone Design"; Trans. Inst. Chem. Eng., Vol. 60, No. 4, July 1982, pp. 222-230; 25 Refs.: TICEA 1 - Separators; Mathematical Models; Cyclone Separator A802; A921

A fundamentally based mathematical model is presented which provides all the details of gas flow and particle motion occurring in cyclone separators. The techniques which have been developed could also be applied to other process operations involving swirling or two-phase flow. The problem of modelling highly swirling flow is overcome by means of an algebraic turbulence model, and all the feature of the experimentally observed gas flow in a cyclone are shown to be successfully reproduced computationally. Grade-efficiency curves are obtained by means of a stochastic particle tracking technique and show good agreement with the experimental data. The resulting computer code offers the possibility of rigorous design of cyclone separators either by its use as a research tool or as a self-contained design method.

2029 Gregor, W.; Schoenert, K. (Univ. Karlsruhe, Inst. Fuer Mechanische Verfahrenstechnik und Mechanik, Karlsruhe, West Ger.), "Efficiency of the Particle Acceleration in

a Jet Pipe"; Powder Technol., Vol. 34, No. 1, Jan.-Feb. 1983, pp. 81-86; 6 Refs: ISSN 0032-5910; POTEB

1 - Grinding Mills - Efficiency A802

In jet-mills the grinding material is accelerated in a jet pipe by means of expanding gas. The efficiency is defined as the ratio of the kinetic energy of the particles at the exit of the pipe and the total applied energy. With an assumption about the velocity distribution in the pipe, a formula is derived for the velocity ratio at the end of the pipe. The ratio, the load, and the geometrical sizes of the pipe influence the efficiency of the particle acceleration.

2033 Dtsuka, Naohiro; Kobayashi, Ryoji (Iwate Univ. JPN), "Studies on Fracture Tougness of Various Rocks"; Nippon Kogyo Kaishi, Vol, 98, No. 1127, Jan. 1982, pp. 1-6; ISSN 0369-4194; NIKKA

1 - Rock Mechanics; Materials - Crack Propagation A483

The splitting tests under the stiff load were undertaken on eight kinds of rocks, including tuff, sandstones, andesite, granite and marbles. The crack initiation and the process of crack propagation were studied by the measurement of splitting load, crack opening displacement and crack length. The values of fracture toughness of various rock specimens were determined with the compliance method, and the relationships between fracture toughness and mechanical properties were investigated. It was found that fracture toughness of rocks increases in proportion to compressive strength, tensile strength and shear strength, and that fracture toughness decreases when the porosity of rocks increases. In Japanese with English abstract.

2046 Herbst, J.A.; Mular, A.L., "Modelling and Simulation of Mineral Processing Unit Operations"; Computer Methods for the 80's in the Mineral Industry, 1979, pp. 823-836

41. Grinding (Comminution), Flotation, Simulation, Beneficiation

See Met. A., 8105-72-0175. Models developed for mineral processing unit operations are based either on mechanisms or on experimental data. Dynamic models are used for control studies and steady state models are used in flowsheet evaluations. Phenomenlogical models of crushers, screens, grinding mills, classifiers and flotation cells are described. Dynamic modelling of

the flotation process is limited by the difficulty in making dynamic measurements. Linear and nonlinear models together with sequential regression techniques are discussed. 131 Ref.

2049 Viswanathan, K; Mani, B.P. (Indian Inst. of Technol. New Delhi, India), "Distribution Functin of Comminution Kinetics - Modelling and Experimental Study"; Int. J. Miner. Process, Vol. 9, No. 4, Oct. 1982, pp. 385-392; 9 Refs.; ISSN 0301-7516; IJMPB

1 - Ore Treatment - Crushing and Grinding A533; A921

A mathematical model for the distribution function is developed considering the distribution of fractures that can occur in a particle. Selection and distribution functions are intimately related through a single parameter - expected number of fractures per unit original size. This parameter can be obtained from batch experiments and used to simulate industrial scale grinding mills.

2070.01 Adel, G.T.; Ulsoy, A.G.; Sastry, K.V.S. (Univ. of Calif. Berkley, USA), "Theoretical Analysis and Control Study of Open-Circuit Grinding"; Int. J. Miner. Process, Vol. 10, No. 1, Jan. 1983, pp. 25-43; 8 Refs.: ISSN 0301-7516: IJMPB

1 - Ore Treatment - Crushing and Grinding A533

Wide fluctuations occurring in the hardness and size distribution of feed materials in regrinding mills result in a non-uniform product fineness and processing inefficiency. Using a previously developed regrinding model, this paper presents the dynamic analysis and design considerations of a control system for open-circuit grinding using traditional P-, PI-, and PID-control algorithims.

2070.07 Kapur, P.C. (Indian Inst. of Technol., Kanpur, India), "Improved Method for Estimating the Feed-Size Breakage Distribution Functions"; Powder Technol., Vol. 33, No. 2, Nov.-Dec. 1982, pp. 269-275; 14 Refs.; ISSN 0032-5910; POTEB

1 - Powders - Crushing and Grinding A804; A802

A new method of graphical display of grinding data as straightline plots is presented the intercepts of which are breakage distribution functions. Using both computer-generated as well as experimental grinding data, it is shown that the proposed method of

estimating breakage distribution functions is highly accurate, is not restricted to short grinding time data and is not subjected to any restrictive interrelationship between breakage-rate constants and breakage distribution functions. As such, this method is an improvement over the existing schemes.

2070.12 Hartley, D.G.; Hayward, P.C.; Sterns, U.J.; Weller, K.R. (Mt. Lyell Min. & Railw. Co. Queenstown, Tasmania, Aust.), "Use of Mathematical Models of Grinding and Classification to Optimize Grinding Circuits at the Mt. Lyell Copper Concentrator, Tasmania"; Min. Eng. (Littleton, Colo.), Vol. 35, No. 1, Jan. 1983, pp. 48-55; 10 Refs.: ISSN 0026-5187; MIENA

1 - Copper Ore Treatment - Crushing and Grinding A533; A921

The major copper loss at Mount Lyell is in the coarsest particles presented to flotation. An analysis of data collected from primary and secondarly ball mill circuits showed that grinding was limited by low breakage rates in secondary mills, possibly due to oversize balls. Frequent steady-state tests indicated that overall average breakage rates could be increased by about 70P using smaller balls. A mathematical simulation of the whole circuit with increased breakage rates showed that the resultant finer grind was likely to improve copper recoveries by about 2P.

2070.29 Paramanathan, B.K.; Bridgewater, J. (Shell Research Bv., Koninklijke/Shelle-Lab Amsterdam, Amsterdam, Neth.), "Attrition of Solids - 2. Material Behaviour and Kinetics Attrition"; Chem. Enc. Sci., Vol. 38, No. 2, 1983, pp. 207-224; 6 Refs.; ISSN 009-2509; CESCA

1 - Solids, Sodium Compounds A 931; A804

An annular cell has been used to follow the attrition of molecular sieve beads, various forms of sodium chloride and sodium carbonate. The mechanisms included removal of surface proturburances, rounding the edges and fragment formation. Spherical sodium chloride degraded to form hemispherical material whereas smaller initially cubic material degraded to form cubes. The masses of attrition products were proportional to "gamma" where "gamma" is the shear strain and M is an index related to the mode of breakdown, a form used previously by J.E. Gwyn. The kinetics of attrition could only be described by a first order process and by including allowances for an initial rapid breakdown and for considering there to be a proportion of material

which is not selected for breakage. A theoretical basis for the Gwyn model is found through a surface abrasion model, the parameter M being found in this model to be a material property.

2070.30 Paramanathan, B.K., Bridgewater, J. (Univ. Birmingham, Dept. Chem. Engn., Birmingham B15 2TT W Midlands, England), "Attrition of Solids .1. Cell-Development"; Chemical Engineering Science. Vol. 38, No. 2, 1983, pp. 197-206, Ref: 021

2105 Austin, L.G.; Brame, K. (Pennsylvania State Univ., Mineral Processing Section, University Park, PA, USA), "Comparison of the Bond Method for Sizing Wet Tumbling Ball Mills with a Size-Mass Balance Simulation Model"; Powder Tehcnol., Vol. 34, No. 2, March-April 1983, pp. 261-274; 28 Refs.: ISSN 0032-5910; POTEB

1 - Grinding Mills - Ball Milling; Crushing and Grinding - Mathematical Models A802; A921

The Bond method or sizing tumbling ball mills has been used successfully for many years. On the other hand, a more detailed method of analysis of the grinding process has been developed in recent years, based on mathematical models of the process. The objective of this paper is to analyze the advantages and disadvantages of the two methods, compare the predictions and show how the advantageous features of each method can be combined.

2121 Chang, Tien-Chien; Wysk, Richard A.; Davis, Robert P.; Choi, B. Young (VA Polytech Inst. & State Univ., Blacksburg, USA), "Milling Parameter Optimization Through a Discrete Variable Transformation"; Int. J. Prod. Res., Vol. 20, No. 4, July-Aug. 1982, pp. 507-516; 18 Refs.: ISSN 0020-7543; IJPRB

1 - Milling - Mathematical Models; Optimization; Production Engineering A604; A921; A901

A mathematical model for milling operations is developed and the five primary control variables identified. The model is then developed and an efficient optimization procedure developed for control variable identification.

2126 Hennings, Kevin; Grant, Doug (Allis-Chalmers Mfg. Co., Milwaukee, WI,: *National Inst. for Occupational Safety and Health, Cincinnati, OH), "Simulation Model for Predicting the Performance of Vibrating Screens"; PB83-

238386, Dec. 82, 121 pages (Bumines-ofr-137-83), Pen File Rept., 29 Jan. 82-30 Nov. 82

13H; 09B; 94G; 41J; *Vibrating Screens, Computerized Simulation, Size Separation, Mathematical Models, Conveyors, NTISDIBM

Screening efficiency models developed to date rely almost exclusively on empirical formulas based upon large amounts of acquired operating data. A screening model was developed using a combination of empirical coefficients and explicit mathematical expressions that quantify screening phenomena. A series of screening tests was run to supply data for purposes of correlation and empirical coefficient evaluation. The model was implemented as a digital computer program. The validity of the modeling procedure was established by laboratory testing. The results were used to compile an applications handbook that can be used to predict screening performance instead of using the computer program.

2129 De Azevado, A.L. Tenuta; Cardoso, M.B. (Usiminas Res. Cent, Ipatinga, Brazil, (BR)), "Decrepitation of Iron Ores: A Fracture-Mechanics Approach"; Ironmaking Steelmaking, Vol. 10, No. 2, 1983, pp. 49-53; ISSN 0301-9233; IMKSB

CA154002; Iron Ore Decrepitation Modeling

Process Simulation, Iron Ores, 7732-18-5

2160.13 De Azevado, A.L. Tenuta; Cardoso, M.B., "Decrepitation of Iron Ores: A Fracture-Mechanics Approach"; Ironmaking Steelmaking, Vol. 10, No. 2, 1983, pp. 49-53; Pub: IBSN: IBSN: ISSN 0301-9233

44, Decomposition Reactions, Fracture Mechanics, Hydrates, Reactions (Chemical), Iron Ores, Mechanical Properties

Compact iron ores are normally considered to be non-hydrated materials. In this paper, it is shown that hydrated phases are present in these ores, occurring as very thin inclusions in the ore interior. On heating, decomposition of these phases takes place producing water vapour which is locked under pressure in the interior. From the principles of fracture mechanics, a theoretical model for this phenomenon was developed that showed quantitatively that the mechanism of bursting under the pressure of the trapped water vapour

is sufficient to produce hematite decrepitation. 11 Ref.

2160.42 Bradley, A.A.; Lloyd, P.J.D. (Chamber Mines S. Africa, Res. Org. Carlow Rd., Johannesburg 2000, South Africa), "Comments on Kinetics of Planetary Ball Mills by Husemann and Jackel"; Powder Technology, Vol. 36, No. 2, 1983, p. 287; Ref: 006

2160.43 Niemi, A.J. (Tech. Res. Ctr. Finland SF 02150 ESP00 15 Finland), "Tracer Analysis and Modeling of Industrial Ore Grinding Systems", Acta Polytechnica Scandinavica - Applied Physics Series, No. 138, 1983, pp. 137-143; Ref: 010

1983 (F) PROCESS ANALYSIS, EFFECTS

2006 King, Dorwin J; Rollwitz, William J., "Magnetic Resonance Measurement of Flowing Coal"; 2 pp. English

2018 Emelchenko, N.V. (Kamaz Truck Plan, Kamaz, USSR), "Feasibility of Combining the Power Grinding and Surface Hardening of Components"; Metal Science and Heat Treatment, Vol. 24, No. 5-6, 1982, pp. 386-388; Ref: 000

2024 Will, O., "Coal Grinding with Direct Firing Mills/Kohlenmahlung mit ein Blasmuehlen"; Zement Kalk Gips, Ed. B, Vol. 35, No. 5, May 1982, pp. 226-229; ZKGBD

1 - Grinding Mills; Coal Preparation; Coal Pulverizers A533; A802; A524

The author shows how it is possible, with the system described embodying a coal grinding mill feeding direct to the kiln, to dispense with the pulverized coal (dedusting) filter and the intermediate storage bin for pulverized coal, while the heat discharged in the mill exhaust gas is utilized and the plant operates with no pollution load on the environment. In German with English abstract.

2032 Turgeon, Jacques; Foy, Gontran (Minist. de l'Energie et des Ressources, Que. Can), "Dry Milling Process for the Production of Ground Mica"; CIM. Bull., Vol. 75, No. 842, June 1982, pp. 79-82; 8 Refs.: ISN 0317-0926; CIBUB

1 - Mica A413; A505; A533

This process permits recovery of about 70P of the mica contained in the ore. Recent work on a wet grinding method to produce very fine mica is also discussed.

2060 Khvostova, V.P.; Golovnya, S.V. (Moscow Rare Met. Ind. Res. Inst., Moscow, USSR), "Chemical Methods of Breaking Down Platinum - Containing Ores and Rocks"; Industrial Laboratory - USSR, Vol. 48, No. 7, 1982, pp. 631-636; Ref: 016

2070.02 Zadorozhyni, G.V.; Rakaev, A.I.; Kizeval'ter, B.V.; Alpatskaya, R.S.; Konyukhova, T.I. (USSR (SU)), "Effect of Initial Ore Processing on the Effectiveness of Grinding and Gravity Beneficiation in Industrial Conditions"; Obogashch. Rud (Leningrad), Vol. 27, No. 5, 1982, pp. 3-5; ISSN 0029-7623; OBOGA

CA154001; Gravity Beneficiation Ore Preliminary Crushing, Slime Beneficiation Ore Crushing

Ore Treatment

2070.03 Kimmel, Edward R. (Chem. Metall. Div., GTE Prod. Corp., Towanda, PA, USA, 18848 (US)), "Effect of Wet Milling Carbide and Cobalt Powders on the Phase Transformation and Morphology of the Cobalt"; Prog. Powder Metal., Vol. 38, No. (Natl. Powder Metall. Conf. Proc., 1982), 1983, pp. 193-201; ISSN 0079-6719; PPWMA

CA156004; Cobalt Phase Transformation Carbide Milling, Tungsten Carbide Cobalt Phase Transformation

12666-46-5

2070.10 Klimpel, Richard R. (Dow Chem. Co., Midland, Mich. USA), "Slurry Rheology Influence on the Performance of Mineral/Coal Grinding Circuits - 2"; Min. Eng. (Littleton, Colo.), Vol. 35, No. 1, Jan. 1983, pp. 21-26; 13 Refs.: ISSN 0026-5187; MIENA

1 - Coal Preparation - Crushing and Grinding A524; A802

Part 2 continues the discussion of a 10-year research and plant testing program. This section illustrates typical industrial test results and identifies some operating implications of controlling rheology by different methods.

2070.15 Klimpel, Richard R. (Dow Chem. Co., Midland, Mich, USA), "Slurry Rheology Influence on the Performance of Mineral/Coal Grinding Circuits"; Min. Eng. (Littleton, Colo.); Vol. 35, No. 12, Dec. 1982, pp. 1665-1668; ISSN 0026-5187; MIENA

1 - Ore Treatment - Crushing and Grinding; Coal Preparation - Breakage A533; A524

The first part of this two-part article summarizes the result of a 10-year research and plant testing program involving operating mining companies throughout the world. The program was aimed at developing a better understanding of the influence of slurry rheology on the performance of mineral/coal grinding circuits. Part 1 presents the basic concepts, including typical laboratory results showing the influence on grinding behavior of controlled changes in percent solids, particle size, slurry temperature, and viscosity control chemicals.

2070.16 Mishra, S.K.; Gupta, A.; Hall, S.T. (Dow Chem. (Australia) Ltd., Australia (AU)), "The Effects of Surface-Active Agents on the Comminution of a Quart-Bearing Gold Ore"; Symp. Ser. - Australia Inst. Min. Metall., Vol. 30, No. (Mill Oper. Conf.), 1982, pp. 123-137; ISSN 0314-6154; SSAMD

CA154001; Grinding Quartz Bearing Gold Ore, Surfactant Gold Ore Grinding

Gold Ores, 2720-73-2; 929-73-7; 81859-78-1

2070.23 Eliseev, N.I.; Boriskov, F.F.; Chanturia, V.A.; Svalov, S.A., "Intensification of the Milling of Sulfide Ores"; Izv. V.U.Z. Tsvethn. Metall., (5), 1982, pp. 7-10; Pub: IBSN: IBSN: ISSN 0021-3438

41, Copper Ores, Beneficiation, Ball Milling, Polarization (Electrodes)

Experiments were carried out to investigate the possibility of intensifying the milling of copper sulfide ores by polarization. By stimulating electrochemical processes in the microcracks formed on the surface of the ore particles, polarization inhibits the healing of the microcracks and thus contributes to the disintegration process. It is shown that milling in a ball mill with polarization produces a 10-12% increase in the yield of the 0.05 mm fraction; the quality of the concentrate improved by 25% while the

extraction of Cu remains essentially the same. 11 Refs.

2070.24 Pryanichnikov, E.V.; Onushko, V.N., Ponomareva, M.S.; Shcherbakov, O.K.; Balashov, G.V. (USSR (SU), "Use of Soda Solution in the Grinding of Ore"; Tsvetn. Met., No. 1, 1983, pp. 85-86; ISSN 0372-2929: TVMTA

CA154001; Ore Grinding Soda Addn., Pegmatite Grinding Soda Addn.

Pegmatite, Ore Treatment, 497-19-8

2070.26 Dombrowe, H.; Hoffman, B.; Scheibe, W. (Forschungsinstitut fuer Aufbereitung, Freiberg, East Ger.), "Mode of Action and Possibilites for Use of Grinding Aids/Uber Wirkungswise und Einsatzmoeglichkeiten vol Mahlhilfsmitteln"; Zement Kalk Gips, Ed. B, Vol. 3, No. 11, Nov. 1982, pp. 571-580; 31 Refs.; ZKGBD

1 - Crushing and Grinding; Cement - Manufacture A802; A412

Taking account of chain length and structure, generally valid selection criteria for grinding aids are derived. The behavior of the grinding plant is explained with particular reference to the conditions in cement grinding. It is shown that both the communication and the transport behavior are affected. In German with English abstract.

2070.32 Gammage, R.B.; Glasson, D.R.; Hodgson, I.R.; O'Neill, P. (Health Saf. Res. Div., Oak Ridge Natl. Lab., Oak Ridge, TN, USA, 37830 (US)), "Microcrystalline Structure of Milled Dolomite and Its Constituent Carbonates"; J. Colloid Interface Sci., Vol. 92, No. 2, 1983, pp. 530-544; ISSN 0021-9797; JCISA

CA149010; Dolomite Milling, Magnesite Milling, Calcite Milling

16389-88-1; 13717-00-5; 13397-26-7

2070.35 Klimpel, R.R. (Cent. Res., Dow Chem. Co., Midland, MI, USA (US)), "The Influence of Slurry Rheology on the Performance of Mineral/Coal Grinding Circuits"; Symp. Ser. - Australas. Inst. Min. Metall., Vol. 30, No. (Mill Oper. Conf.), 1982, pp. 1-14; ISSN 0314-6154; SSAMD

CA154000; Review Ore Grinding Slurry Rehol.

Ore Treatment, Rheology, Copper Ores, Coal

2070.43 Grizina, K. (Lurgi Chem. & Huttentech Gmbh, Ha Aufbereitung Abt, Gervinusstr 17 19 D-6000 Frankfurt 1 Fed. Rep. Ger.); "Studies on the Dissolution Behavior of Vanadium Pentoxide Activated by Grinding in Water, Paying Special Attention to the Kinetics of Dissolution"; Chemie Ingenieur Tecnik., Vol. 55, No. 1, 1983, pp. 70-71; Ref: 008

2070.45 Tucker, P. (Warren Spring Lab, Stevanage, Hertfordshire, Engl.), "Rheological Factors that Affect the Wet Grinding of Ores"; Trans. Inst. Min. Metall., Sect. C, Vol. 91, Sept. 1982, pp. 117-122; 18 Refs; ISSN 0371-9553; TMEMA

1 - Ore Treatment - Crushing and Grinding; Crushing and Grinding - Rheology A533; A931

The particle-size distributions and rheological properties of the products of a laboratory rod-mill were measured for a lead-zinc ore ground for a range of times and at various pulp densities. At high pulp densities size reduction was strongly influenced by the rheology. In particular, the size reduction that resulted from compressive stress breakage was limited by the effective viscosity at low shear rates. The correlation between rheology and size reduction is discussed and the value of grinding aids examined.

2103 Sacks, Michael D.; Tseng Tseung-Yuen (Univ. of Florida, Dept. of Materials Science & Engineering, Gainesville, Fla., USA), "Role of Sodium Citrate in Aqueous Milling of Aluminum Oxide"; J. Am. Ceram. Soc., Vol. 66, No. 4, Apr. 1983, pp. 242-247; 54 Refs; ISSN-002-7280; JACTA

1 - Alumina - Physical Chemistry; Ceramic Materials - Grinding A812; A801; A604

A study was initiated to identify the mechanism(s) by which chemical additives affect aqueous milling of oxide suspensions. Properties of milled AL//20//3 suspensions containing sodium citrate were correlated with ground-powder characteristics. Maximum grinding efficiency was obtained at the sodium citrate concentration which resulted in the maximum (absolute value) zeta potential and the minimum suspension viscosity. The results indicate that sodium citrate indirectly affects comminution by altering the particle arrangements (state of dispersion) in suspension.

2130 Narayanan, S.; Raghunathan, N.; Nayak, U.B.; Hakiri, A.K. (Indian Inst. of Science, Dept. of Metallurby, Bangalore, India), "Environmental Effects on Grinding"; Int. J. Miner. Process., Vol. 10, No. 4, June 1983, pp. 309-317; 6 Refs.; ISSN 0301-7516; IJMPB

1 - Iron Ore Treatment - Crushing and Grinding A533; A802; A804

The effect of surface-active agents in improving the grinding efficiency for haematite, expressed as a measure of reduction ratio, has been studied. Drying of the feed before grinding improves the grinding efficiency. The effect of surfactant additions on hardness, microhardness, crushing strength and wet grinding has shown that dispersants are better than flocculants, and each dispersant has a critical concentration at which the grinding efficiency is maximum.

2133 Lehman, Richard L.: Shepard, John A.: Skorski, Charles F.; Kelso, Fred J. (Rutgers Univ., New Brunswick, NJ, USA), "NAOH-STPP Thinner Improves Wet Grinding of Phosphate Rock"; Eng. Min. J., Vol. 184, No. 6, June 1983, pp. 90-94; 9 Refs.: ISSN 0095-8948; ENMJA

1 - Phosphate Ore Treatment - Crushing and Grinding A533; A802

Mixtures of the chemical additives NAOH, NA//2CO//3, and sodium tripolyphosphate (STPP) have been evaluated for their ability to reduce the viscosity and improve the grinding efficiency of a 75% solids slurry of Florida phosphate rock. The cost-effectiveness of these mixtures was determined based on increased P//20//5 recovery and on reduced costs of double liming of pond water. The strongest performance was identified within the NaOH-STPP binary system and a mixture of 65P NaOH (of a 50P solution) plus 35P STPP was determined to be the most cost-effective mixture for a variety of phosphate rock types.

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Surface activation grinding chemisorption gas, propane chemisorption magnesia mech activation, propylene chemisorption magnesia mech activation, oxygen chemisorption magnesia mech activation, nitrous oxide chemisorption magnesia mech activation, hydrogen chemisorption magnesia mech activation, carbon monixide chemisorption magnesia mech activiation, magnesia chemisorption gas magnesia mech activation.

Chemisorption, Kinetics of Chemisorption, Energy Transfer, 1309-48-4; 115-07-1; 630-08-0; 1333-74-0; 10024-97-2; 7782-44-7; 74-98-6

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42, Tungsten Compounds, Extraction, Ball Milling, Surface Activation, Leaching

See Met. A., 8209-42-1257.

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41, Clinker, Beneficiation, Particle Size Distribution, Ball Milling, Charge Materials

Two parameters, I.E. N from the RRS log network and M from the Alajudin's equation for kinetics of grinding, have been used for presenting the influence of the size of grinding balls on the grain size distribution of ground clinker and for presenting the kinetics of grinding. The value of parameter N was found to increase with grinding time until agglomeration occurs. The parameter N also increases when grinding the samples with balls of greater dia. as against grinding with balls of smaller dia., but only in that case when the balls, according to their size, energetically correspond with the grain size of the material to be ground. Equally, the specific surface area increase of the grind has been observed for each fraction ground with balls of corresponding size on passing over from the balls of larger to those of smaller dia. In the present test it was ascertained that the grinding intensity increases with increasing parameters M and that at its highest value the ball size is also optimum. The influence of the feed grain size of clinker, ball size and grinding time on the efficiency of grinding was shown by the formation rate of fraction 45 μm. The efficiency of grinding with balls of a certain dia. depends on the grain size of grinding charge and a lawful relation exists between them.

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1 - Milling A604

A study was made of the effects of liquid indium, indium/gallium eutectic, and organic media (solutions of oleic acid and rubber in toluene and kerosine) on the process of iron milling establishing that fine milling of iron becomes possible only when small amounts of liquid indium/gallium eutectic are present. The results obtained by size reduction in a vibratory mill were compared with the results obtained by the electrocondensation method for preparing from organosols; this comparison shows that the intensity of size reduction increases with increasing stabilizing power of the medium. A method was developed for obtaining a stable iron organosol containing approximately 1P metal, with a degree of magnetizatin of 470 A/M at a magnetic field strength of 2.8 * 10**4 A/M.

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1 - Ore Treatment - Crushing and Grinding A533; A723

The methodology employed to develop a digital simulation of the Brenda Mines Ltd., Peachland, B.C., secondary crushing plant includes data acquisition, data adjustment, model building, and the construction of a simulator structure. The simulator was utilized to study the effects of secondary and tertiary crusher close side settings, secondary screen opening, plant feed rate, and percent + 1 in. In the feed on the following responses: percent - 1/2 in. in the final product. Pliant reduction ratio, circulating load ration, and screen efficiency.

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See Met. A., 8105-72-0175. Control strategies for conventional grinding circuits are reviewed with particular reference to single stage systems. Majority of systems are classified as classical control strategies in which product size is controlled by sump water addition rate or fresh solids feed rate. Modern control theories include decoupling and optimal controls and filtering and parameter estimations. A series of case studies illustrate the various techniques. 35 Ref.

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1 - Crushers - Design A533

In connection with the design of materials preparation plants it often happens that comminution circuits have to be calculated. This is liable to cause difficulties in all the preparatory processing stages, as the recycled material in a circuit is very difficult to determine. In this article an attempt is made to show how the mass flow conditions in a circuit can be ascertained from investigations conducted in the laboratory or on a semi-industrial scale using experimental machines. After some considerations relating to the comminuting behavior of crushers and mills, the author goes on to describe how the characteristic of a crusher can be recorded using an experimental machine. With reference to an analysis and optimization of an existing comminution circuit he then shows how the investigations can be applied in actual practice. In German.

2070.48 Austin, L.G.; Luckie, P.T.; Shoji, K. (PA State Univ., University Park, USA), "Analysis of Ball-and-Race Milling - 3. Scale-up to Industrial Mills"; Powder Technol., Vol. 33, No. 1, Sept-Oct 1982, pp. 127-134; 5 Refs.: ISSN 0032-5910; POTEB

1 - Grinding Mills - Ball Milling; Coal Preparation - Breakage A802; A524

The scale-up of breakage parameters measured in the Hardgrove Mill to large mill diameters, using a simulation model for continuous milling, is discussed. The variations in fineness of grind with mill capacity, Hardgrove grindability index, classifier setting and air-coal ratio are described. Results from an E1.7 mill agree with model predictions.

2070.50 Austin, L.G.; Luckie, P.T.; Shoji, K. (PA State Univ., University Park, USA), "Analysis of Ball-and-Race Milling - 2. The Babcock E.1.7 Mill"; Powder Technol., Vol. 33, No. 1, Sept-Oct 1982, pp. 113-125; 4 Refs.: ISSN 0032-5910: POTEB

1 - Grinding Mills - Mathematical Models A802; A921

A mathematical model was developed for a ball-and-race mill based on specific rates of breakage and primary fragment distributions. The model includes internal classification of particles falling back into the race and external classification due to the built-on classifier. It was demonstrated that the normalized primary fragment distribution produced in a pilot scale Babcock E-type mill of 17 in. race diameter was the same as in the Hardgrove laboratory test mill and that the specific rates of breakage varied with particle size in the same manner. Model simulations correctly predicted the product size distribution from the E-type mill.

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1 - Ore Treatment - Grinding; Grinding Mills - Control Systems A531; A802; A731

The dynamic behavior of a pilot-plant grinding circuit was modelled by relating three output variables that were representative of the conditions within the mill and the classifier to three input variables, namely feed rates of the solids, mill water, and sump water. A multivariable controller was designed, by the use of the inverse Nyquist array techniques, for feedback control of the outputs by the inputs and applied to the plant by a process-control computer with the use of direct digital counter.

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1 - Ore Treatment - Crushing and Grinding; Grinding Mills - Ball Milling A533; A911

A comminution model and a quick laboratory milling test procedure allow the determination of milling parameters for the optimization of ball size and pulp density in operating mills, estimation of the performance of new feedstocks in an existing mill, and estimation of the expected milling performance for a new project. Information on the estimation of the size of mills to deliver specified amounts of comminution energy and of the amount of expected ball, rod and liner wear to allow cost estimates is included.

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41, Sulfides, Beneficiation, Ores, Grinding (Comminution), Classification, Gravity Concentrators

Three important aspects of mineral-beneficiation practice, batch grinding on a laboratory scale, classification and gravity separation, were analyzed in a determination of the effect of a grinding aid made by

Dow Chemicals, XFS U.27200 on each of their respective process environments. For the batch-grinding environment, it was found that fairly severe process conditions (a pulp density of 85% solids, grinding aid at a concentration of 2 kg/ton and a grinding time of 30 min) were necessary before significant increases were achieved in the grinding rates. These process conditions produced an average increase in the fineness of the product of 4.7%. The effect of the grinding aid on classification was studied by the passing of the pulp, in turn, through 25 and 50 mm hydrocyclones and a 150 mm spiral classifier, different additions of grinding aid being used in each case. The results showed that there was a tendency for the uncorrected cut size to reduce slightly and for the sharpness of particle classification to improve marginally when the aid was introduced. Closed-circuit tests with a spiral concentrator showed that dosages of between 50 and 300 G/ton improved the grade and recovery of concentrate, but that, at dosages of 500 G/ton, the grade and the recovery began to decrease.

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1 - Screens and Sieves - Computer Simulation A405; A502; A723

Before development of the screening model, an attempt was made to simulate, by digital computation, the conveyance characteristics of a particle travelling on a vibrating surface. This enables velocity and approach angle for any given deck material or screen inclination angle to be determined analytically.

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